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(21)Application number : 2002-075292 (71)Applicant : KANEKA FUCHI CHEM IND CO LTD

(22)Date of filing : 19.03.2002 (72)Inventor : OUCHI KATSUYA
FUJITA MASAYUKI
TSUMURA MANABU
IDE MASAHIKO

(54) SEALANT, METHOD FOR SEALING SEMICONDUCTOR OR THE LIKE, METHOD FOR PRODUCING SEMICONDUCTOR DEVICE, AND SEMICONDUCTOR DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a highly practical sealant which has high adhesiveness, low viscosity, and low temperature rapid curing performance; a method for sealing an electronic parts, an electric circuit, an electric contact or a semiconductor by using the sealant; a method for producing a semiconductor device; and a semiconductor device wherein a semiconductor is sealed by the sealant.
SOLUTION: The sealant comprises as essential components (A) an organic compound having at least two carbon–carbon double bonds reactive with an SiH group in one molecule, (B) a compound having at least two SiH groups in one molecule, and (D) an adhesive agent.

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CLAIMS

[Claim(s)]

[Claim 1](A) Encapsulant containing an organic compound which contains a carbon-carbon double bond which has a SiH group and reactivity in [at least two] one molecule, a compound which contains at least two SiH groups in one molecule (B), the (C) hydrosilylation catalyst, and (D) adhesion grant agent as an essential ingredient.

[Claim 2](D) The encapsulant according to claim 1 which is a compound in which an ingredient contains an epoxy group in a molecule.

[Claim 3] The encapsulant according to claim 2 which furthermore contains a silanol condensation catalyst as a (E) ingredient.

[Claim 4](E) The encapsulant according to claim 3 whose silanol condensation catalysts of an ingredient are a boron system compound or/and an aluminum system compound or/, and a titanium system compound.

[Claim 5] The encapsulant according to any one of claims 2 to 4 which furthermore contains carboxylic acid or/, and acid anhydrides as a (F) ingredient.

[Claim 6] The encapsulant according to any one of claims 1 to 5 used in order to close a semiconductor.

[Claim 7] Under-filling which consists of the encapsulant according to claim 6.

[Claim 8] Electronic parts closing electronic parts, an electric circuit, or electric contact with encapsulant or a statement in any 1 paragraph of claims 1 thru/or 5, an electric circuit, a sealing method of electric contact.

[Claim 9] A sealing method of a semiconductor closing a semiconductor by encapsulant according to claim 6 or the under-filling according to claim 7.

[Claim 10] A manufacturing method of a semiconductor device closing a semiconductor by encapsulant according to claim 6 or the under-filling according to claim 7.

[Claim 11] A semiconductor device with which encapsulant according to claim 6 or the under-filling according to claim 7 comes to close a semiconductor.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to encapsulant and a still more detailed high adhesive property is shown. Are hypoviscosity and low-temperature fast curability and by the high encapsulant of practicality, and it Electronic parts. It is related with the sealing method of the electronic parts which close an electric circuit, electric contact, or a semiconductor, or a semiconductor package, etc. in recent years TAB closure, Liquefied encapsulants including the under-filling closure for flip chip bonding, etc. are used, and the epoxy resin composition which mainly used the epoxy compound, the acid anhydride system hardening agent, and the inorganic filler as the main ingredients is widely used for these liquefied encapsulants. The fundamental characteristic required of such encapsulants is heat resistance, an adhesive property, etc. which do not make parts produce fault also by heat histories, such as a solder reflow.

[0003] Generally, hardening takes an elevated temperature and a long time to an epoxy resin composition. manufacture of a semiconductor package etc. is difficult for it, and although a manufacturing cycle may become long, in order to manufacture easily, to make a cycle quick and to reduce a manufacturing cost, low-temperature fast curability is demanded. In liquefied encapsulant, the high-speed perviousness to the slit by the further fluid improvement by enlargement of a semiconductor and densification, etc. is called for.

[0004] In order to improve low-temperature fast curability and high-speed perviousness which were described above, various improvement is proposed in the epoxy resin (JP5-222270A, JP6-5743A, JP6-206982A, JP7-165876A, JP9-31161A, JP9-246435A, JP10-101906A, JP11-21421A, JP11-925459A, JP11-140069A, JP11-255864A, JP11-256012A, JP11-269250A, JP2000-3932A, JP2000-7891A, JP2000-53844A, JP2000-63630A).

[0005] On the other hand, the hardenability constituent which generally used the hydrosilylation reaction with quick hardenability for the hardening reaction is also proposed (JP,50-100A, JP,9-291214A, JP,1-126336A, JP,5-295270A).

[0006] A high adhesive property is required of encapsulant.

[0007] [Problem(s) to be Solved by the Invention] Therefore, the encapsulant whose practicality the purpose of this invention shows a high adhesive property, and are hypoviscosity and low-temperature fast curability, and is high, it is providing the sealing method of the electronic parts which close electronic parts, an electric circuit, electric contact, or a semiconductor by it, an electric circuit, or a semiconductor or the manufacturing method of a semiconductor device, and the semiconductor device with which it comes to close a semiconductor.

[Means for Solving the Problem] An organic compound in which this invention persons contain wholeheartedly a carbon-carbon double bond which has the (A) SiH group and reactivity in [at least two] one molecule as a result of research in order to solve this technical problem. (B) By containing a compound and (D) adhesion grant agent which contain at least two SiH groups in one molecule as an essential ingredient, it found out that an aforementioned problem was solvable and resulted in this invention.

[0009] Namely, an organic compound in which this invention contains a carbon-carbon double bond which has the (A) SiH group and reactivity in [at least two] one molecule, (B) A compound, the (C) hydrosilylation catalyst which contain at least two SiH groups in one molecule, (D) It is the encapsulant (claim 1) containing an adhesion grant agent as an essential ingredient, (D) An ingredient is the encapsulant (claim 2) according to claim 1 which is a compound which contains an epoxy group in a molecule. It is the encapsulant (claim 3) according to claim 2 which furthermore contains a silanol condensation catalyst as a (E) ingredient, (E) A silanol condensation catalyst of an ingredient is the encapsulant (claim 4) according to claim 3 which are a boron system compound or/ and an aluminum system compound or/ and a titanium system compound . Furthermore, contain carboxylic acid or/ , and acid anhydrides as a (F) ingredient. It is the encapsulant (claim 5) according to any one of claims 2 to 4. Are the encapsulant (claim 6) according to any one of claims 1 to 5 used in order to close a semiconductor, are under-filling (claim 7) which consists of the encapsulant according to claim 6, and with encapsulant of a statement in any 1 paragraph of claims 1 thru/ or 5 Electronic parts, an electric circuit, Or electronic parts, an electric circuit closing electric contact, It is a sealing method (claim 8) of electric contact, and is a sealing method (claim 9) of a semiconductor closing a semiconductor by encapsulant according to claim 6 or the under-filling according to claim 7. It is a manufacturing method (claim 10) of a semiconductor device closing a semiconductor by encapsulant according to claim 6 or the under-filling according to claim 7. It is a semiconductor device (claim 11) with which encapsulant according to claim 6 or the under-filling according to claim 7 comes to close a semiconductor.

[0010]

[Embodiment of the Invention] Hereafter, this invention is explained in detail.

(A) ingredient) The (A) ingredient in this invention is explained first.
[0011] (A) Especially if an ingredient is an organic compound which contains the carbon-carbon double bond which has a SiH group and reactivity in [at least two] one molecule, it will not be limited. It is preferred that it is what does not include siloxane units (Si—O—Si) like polysiloxane organicity block copolymer or a polysiloxane organicity graft copolymer as an organic compound, and contains only C, H, N, O, S, and halogen as a composing element. In the case of a thing including siloxane units, there is a problem of gas permeation nature or crawling.

[0012] The connecting position in particular of the carbon-carbon double bond which has a SiH group and reactivity is not limited, but may exist anywhere in intramolecular.

[0013] (A) The organic compound of an ingredient can be classified into the compound and organic monomer system compound of an organic polymer system.

[0014] (A) As an organic polymer system compound, for example, a polyether system, The compound of a polycarbonate system, a saturated hydrocarbon system, an unsaturation hydrocarbon system, a polyacrylic ester system, a polyamide system, a phenolformaldehyde system (phenol resin system), and a polyimide system can be used.

[0015] (A) As an organic monomer system compound, these mixtures, etc. of an aliphatic hydrocarbon system/heterocyclic system, such as aromatic hydrocarbon system: straight chain systems, such as a phenol system, a bisphenol system, benzene, and naphthalene, and an alicycle system, are mentioned.

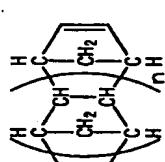
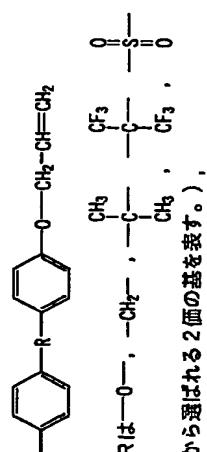
[0016] (A) Although not limited especially as a carbon-carbon double bond which has a SiH group of an ingredient, and reactivity, it is following general formula (III).

[0017]

[Formula 1]

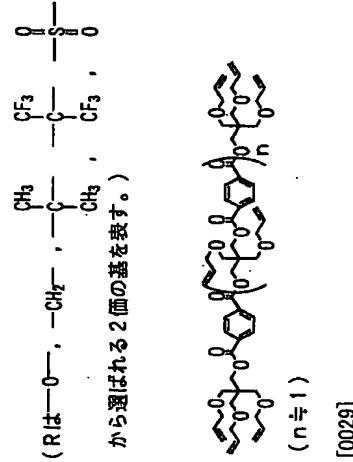
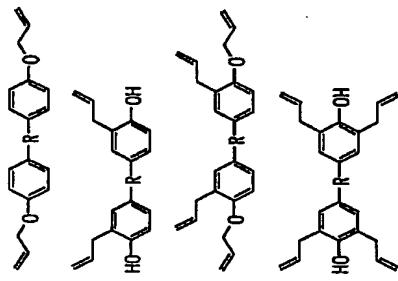


$-\left(\text{CH}_2\text{CH}_2\text{O}\right)_n\text{CH}_2\text{CH}=\text{CH}_2$
(n は5≤ n ≤2を満足する数を表す。),

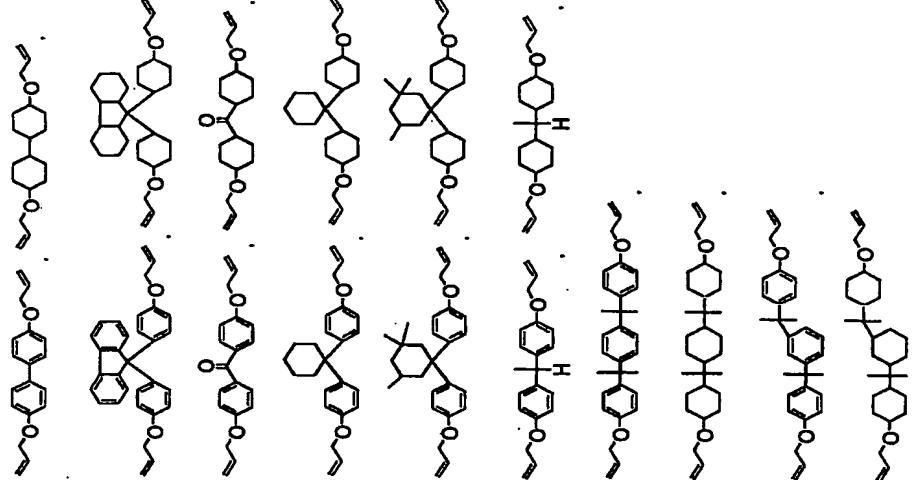


*****.

[0027]As a concrete example of an ingredient, (A) Diallyl phthalate, triallyl trimellitate, Diethylene-glycol bisallyl carbonate, trimethylolpropane diary ether, Pentaerythritol triary ether, 1,1,2,2-, tetra allyloxy ethane, Diallylideneidenepenta Etilsitr, triary cyanurate, triallyl isocyanurate, 1,2,4-TORIBI nil cyclohexane and divinylbenzenes (the thing of 50 to 100% of purity.) Preferably The thing of 80 to 100% of purity, divinylbiphenyl, 1, 3-diisopropenylbenzene, 1,4-diisopropenylbenzene, and those oligomer, 1,2-polybutadiene (1, the thing of 10 to 100% of two ratios, preferably thing of 50 to 100% of 1 and 2 ratio), allyl ether of novolac phenol, arylation polyphenylene oxide. [0028]
[Formula 8]



[0029]
[Formula 9]



[0033](A) It is preferred that reactivity contains one or more vinyl groups in one molecule from a viewpoint of being good, as an ingredient, and it is more preferred to contain two or more vinyl groups in one molecule. It is preferred to contain six or less vinyl groups in one molecule from a viewpoint that storage stability becomes good easily, and it is more preferred to contain four or less vinyl groups in one molecule.

[0034](A) As an ingredient, from a viewpoint that dynamic heat resistance is high, and a viewpoint that there is little cobwebbing nature of raw material liquid, and a moldability and handling nature are good, less than 900 thing has a preferred molecular weight, less than 700 thing is more preferred, and less than 500 thing is still more preferred.

[0035](A) As an ingredient, in order to acquire uniform mixing with other ingredients, and good workability, as viscosity, a thing below 1000 poise is preferred in 23 ***, a thing below 300 poise is more preferred, and a thing below 30 poise is still more preferred. Viscosity can be measured with E type viscosity meter.

[0036](A) What has few content of a compound which has a derivative of a phenolic hydroxyl group and/or a phenolic hydroxyl group from a viewpoint of coloring, especially control of yellowing as an ingredient is preferred. What does not contain a compound which has a derivative of a phenolic hydroxyl group and/or a phenolic hydroxyl group is preferred. With a phenolic hydroxyl group in this invention, the benzene ring, a naphthalene ring, A hydroxyl group coupled directly with an aromatic hydrocarbon core illustrated by anthracene ring, etc. is shown. A derivative of a phenolic hydroxyl group shows a basis replaced in a hydrogen atom of an above-mentioned phenolic hydroxyl group by acyl groups, such as alkanyl groups, such as alkyl groups, such as a methyl group and an ethyl group, a vinyl group, and an allyl group, and an acetoxyl group, etc.

[0037]While an optical property is good like a photoelastic coefficient with a low double refraction factor being low, weatherability from a viewpoint of being good. That whose component weight ratio in the (A) ingredient of an aromatic ring is 50 or less % of the weight is preferred, 40 or less % of the weight of a thing is more preferred, and 30 or less % of the weight of a thing is still more preferred. Most desirable one does not include aromatic hydrocarbon rings.

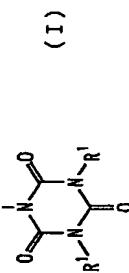
[0038]From a viewpoint that there is little coloring of a hardened material obtained, optical transparency is high, and lightfastness is high. As an ingredient, (A) A vinylcyclohexene, a dicyclopentadiene, Triallylisocyanurate, diaryl ether of 2,2-bis(4-hydroxycyclohexyl)propane, 1,2,4-TORBI nil cyclohexane is preferred and triallyl isocyanurate, diaryl ether of 2,2-bis(4-hydroxycyclohexyl)propane, and especially 1,2,4-TORBI nil cyclohexane are preferred.

[0039](A) As an ingredient, it may have other reactant groups. As a reactant group in this case, an epoxy group, an amino group, a radical polymerization nature unsaturation group, a carboxyl group, an isocyanate group, hydroxy, alkoxy silyl groups, etc. are mentioned. When it has these functional groups, intensity of a hardened material obtained by the adhesive property of a hardenable constituent obtained becoming high easily becomes high easily. From a point that an adhesive property can become higher, an epoxy group is preferred among these functional groups. In a point that the heat resistance of a hardened material obtained becomes high easily, it is preferred to average a reactant group and to have in [one or more] one molecule.

[0040](A) Independent, two or more sorts of things are mixed, and an ingredient can be used.

[0041](A) Following general formula (I) from a viewpoint that heat resistance and transparency are high as an ingredient

[0042]
[Formula 10]



What transposed some or all of the Grouchy Jill group of the conventionally publicly known epoxy resin besides ** to the allyl group is mentioned.

[0050](A) The low molecular weight compound which is divided into a skeletal part and an alkanyl group as mentioned above, and is hard to express as an ingredient can also be used. As an example of these low molecular weight compounds, butadiene, isoprene, Aliphatic series chain polyene compound systems, such as octadien and decadiene, a cyclopentadiene, Substitution aliphatic series cyclic olefin compound systems, such as aliphatic series cyclic polyene compound systems, such as cyclohexadiene, cyclooctadiene, a dicyclopentene, tricyclo pentadiene, and norbornadiene, vinylcyclopentane, and a vinyliccyclohexene, etc. are mentioned.

[0051](A) As an ingredient, heat resistance from a viewpoint that it may improve more. A thing containing 0.001 mol or more per g of (A) ingredient of carbon-carbon double bonds which have a SiH group and reactivity is preferred, what is contained 0.005 mol or more per g is more preferred, and what is contained 0.008 mol or more is still more preferred.

[0052](A) As for a SiH group of an ingredient, and the number of carbon-carbon double bonds which have reactivity, even if small [per molecule] on the average, it is preferred [with two pieces], although it is good to exceed 2 to improve dynamics intensity more, and it is more preferred that they are three or more pieces. (A) When a SiH group of an ingredient and the number of carbon-carbon double bonds which have reactivity are one or less per 1 intramolecular, even if it reacts to the (B) ingredient, it does not become the structure of cross linkage only by becoming graft structure.

(the organic group of the monovalence of the carbon numbers 1~50 may be expressed, and each R' may differ or that of R' in a formula may be the same.) — the compound expressed is preferred.

[0043]From a viewpoint that the heat resistance of the hardened material obtained can become higher as

reactivity becomes good. [0051]

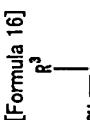
[Formula 15]



It is preferred that it is an organic group of the monovalence of the carbon numbers 1~50 which come out and contain one or more bases expressed, and it is following general formula (III).

[0052]

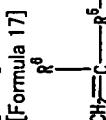
[Formula 16]



(R^3 in a formula expresses a hydrogen atom or a methyl group) — it is more preferred that it is an organic group of the monovalence of the carbon numbers 1~50 containing one or more bases expressed — the inside of three R^1 — at least two — following general formula (V).

[0053]

[Formula 17]



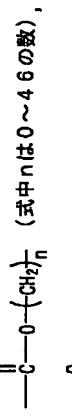
(R^5 in a formula an organic group of bivalence of direct coupling or the carbon numbers 1~48) [express and] R^6 expresses a hydrogen atom or a methyl group. It is still more preferred that it is an organic compound (two or more R^5 and R^6 may differ from each other, respectively, or may be the same.) expressed.

[0054] Although R^5 of the above-mentioned general formula (V) is an organic group of bivalence of direct coupling or the carbon numbers 1~48, From a viewpoint that the heat resistance of a hardened material obtained can become higher. It is preferred that it is an organic group of bivalence of direct coupling or the carbon numbers 1~20, it is more preferred that it is an organic group of bivalence of direct coupling or the carbon numbers 1~10, and it is still more preferred that it is an organic group of bivalence of direct coupling or the carbon numbers 1~4. As the example of these desirable R^5 , [0055]

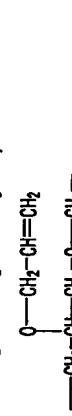
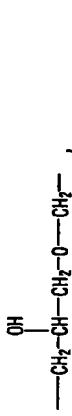
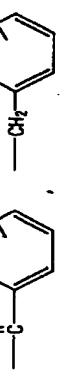
[Formula 18]



(O is 0 ~ 4 6 の数),



(O is 0 ~ 4 6 の数),



[0055] Although R^6 of the above-mentioned general formula (V) is a hydrogen atom or a methyl group, from a viewpoint that reactivity is good, its hydrogen atom is preferred.

$\text{CH}_3 - \left(\begin{array}{c} \text{CH}_3 \\ | \\ -\text{S}-\text{O}- \\ | \\ \text{CH}_3 \end{array} \right) - \left(\begin{array}{c} \text{CH}_3 \\ | \\ -\text{S}-\text{O}- \\ | \\ \text{H} \end{array} \right) - \text{CH}_3$ (m)

$\text{CH}_3 - \left(\begin{array}{c} \text{CH}_3 \\ | \\ -\text{S}-\text{O}- \\ | \\ \text{CH}_3 \end{array} \right) - \left(\begin{array}{c} \text{CH}_3 \\ | \\ -\text{S}-\text{O}- \\ | \\ \text{H} \end{array} \right) - \text{CH}_3$ (n)

$m = 0 \sim 1000, n = 0 \sim 1000$

$\text{CH}_3 - \left(\begin{array}{c} \text{CH}_3 \\ | \\ -\text{S}-\text{O}- \\ | \\ \text{CH}_3 \end{array} \right) - \left(\begin{array}{c} \text{CH}_3 \\ | \\ -\text{S}-\text{O}- \\ | \\ \text{H} \end{array} \right) - \text{CH}_3$ (m)

$\text{CH}_3 - \left(\begin{array}{c} \text{CH}_3 \\ | \\ -\text{S}-\text{O}- \\ | \\ \text{CH}_3 \end{array} \right) - \left(\begin{array}{c} \text{CH}_3 \\ | \\ -\text{S}-\text{O}- \\ | \\ \text{H} \end{array} \right) - \text{CH}_3$ (n)

$m = 0 \sim 1000, n = 0 \sim 1000$

$\text{CH}_3 - \left(\begin{array}{c} \text{CH}_3 \\ | \\ -\text{S}-\text{O}- \\ | \\ \text{CH}_3 \end{array} \right) - \left(\begin{array}{c} \text{CH}_3 \\ | \\ -\text{S}-\text{O}- \\ | \\ \text{H} \end{array} \right) - \text{CH}_3$ (n)


 $(n = 0 \sim 1000)$

$$\left(\text{C}_6\text{H}_5-\text{Si}-\overset{\text{O}}{\underset{\text{H}}{\text{—}}} \right)_n \quad (n=3 \sim 10).$$

00666] From a view
carbon-carbon dou-
) following general
0067]
Formula 23]

among a formula, R^2 expresses the organic group of the carbon numbers 1–6, and n expresses the number of substituents (3–10) — the annular polyorganosiloxane which is expressed and which has at least three SiH groups in one molecule is preferred.

comprise C, H, and O, it is more preferred that it is a hydrocarbon group, and it is still more preferred that it is a methyl group.

[0069] From acquisition ease etc., it is preferred that it is 1, 3, 5, and 7-tetramethyl cyclotetrasiloxane.
[0070] A thing [a thing] described above and which are independent, or mixes two or more sorts of things, and is used is possible for an ingredient in some numbers (beta).

As (a reaction of a SiH group), an organic compound which contains a carbon–carbon double bond which has reactivity in [at least two] one molecule, and an ingredient (beta), next a (A) ingredient of this invention. A case where a compound which can obtain an organic compound and an ingredient (beta) which contain a carbon–carbon double bond which has a SiH group and reactivity in [at least two] one molecule by their ability to carry out a hydrosilylation reaction is used. A hydrosilylation reaction of an organic compound and an ingredient (beta) which contain a carbon–carbon double bond which has a SiH group and reactivity in [at least two] one molecule is explained.

[0071]With the hydroxylations reaction of an aromatic C

[001] When the hydrostabilization reaction of an organic compound and an ingreident, (A), which contain a carbon-carbon double bond which has a SiH group and reactivity in [at least two] one molecule is carried out, a mixture of two or more compounds containing the (A) ingredient of this invention may be obtained, but without separating the (A) ingredient from there, it can use with a mixture and a hardenability constituent of this invention can also be created.

[0072] A case where the hydrosilylation reaction of an organic compound and an ingredient (beta) which

contain a carbon–carbon double bond which has a SiH group and reactivity in [at least two] one molecule is carried out. The mixing ratio of a SiH group, an organic compound which contains a carbon–carbon double bond which has reactivity in [at least two] one molecule, and an ingredient (β), In a point that gelling under reaction can be controlled although not limited in particular, Total (X) of a carbon–carbon double bond which generally has the reactivity of a SiH group to mix and a SiH group in an organic compound which contains a carbon–carbon double bond which has reactivity in [at least two] one molecule, It is preferred that a ratio with a total (Y) of a SiH group in an ingredient (β) to mix is $X/Y \geq 2$,

ingredient becomes good easily, it is preferred that it is $10 > X/Y$ and it is more preferred that it is $5 > X/Y$.

[0073] A suitable catalyst may be used when carrying out the hydrosilylation reaction of an organic compound and an ingredient (beta) which contain a carbon-carbon double bond which has a SiH group and reactivity in [at least two] one molecule. As a catalyst, the following can be used, for example. A thing which made carriers, such as a simple substance of platinum, alumina, silica, and carbon black, support solid platinum, A complex with chloroplatinic acid, alcohol, aldehyde, ketone, etc., Platinum-olefin complex (for example, it $\text{Pt}(\text{CH}_2=\text{CH}-)_2^{\text{P}(\text{Ph})_3^-}$ and $\text{Pt}(\text{CH}_2=\text{CH}_2)_2\text{Cl}_2$, Platinum-vinyl siloxane complex (for example, it $\text{Pt}(\text{VMe}_2-\text{SiOSiMe}_2-\text{Vi})_n$ and $\text{Pt}[\text{MeVSiO}]_4$), a platinum-

phosphine complex. (For example, $\text{Pt}(\text{PPh}_3)_4$, $\text{Pt}(\text{PBu}_3)_4$, a platinum-phosphite complex (for example, $\text{Pt}([\text{P}(\text{OPh})_3]^-\text{[4 and]}\text{Pt}[\text{P}(\text{OBu})_3]^4$ (among a formula, a methyl group and Bu express a butyl group, Vi expresses a vinyl group, Ph expresses a phenyl group as for Me, and n and m) An integer is shown. A platinum-hydrocarbon complex indicated in dicarbonyl dichloroplatinum, a curl SHUTETO (Karstedt) catalyst, U.S. Pat. No. 3159601 of Ashby (Ashby), and the No. 3159662 specification, And a platinum alcoholate catalyst indicated in a U.S. Pat. No. 3220972 specification of RAMORO (Lamoreaux) is mentioned. A platinum chloride-olefin complex indicated in a U.S. Pat. No. 3516946 specification of Modic

(0074) Is also useful in *cis*-isomerization.

[RuCl₃] is an example of catalysts other than a platinum compound, RhCl(PPh)₃, RhAl₂O₃, RuCl₃, FeCl₃, AlCl₃, PdCl₂ and HgO, NiCl₂, TiCl₄, etc. are mentioned.

[0075] In these, chloroplatinic acid, a platinum- α -olefin complex, a platinum-vinyl siloxane complex, etc. are preferred for a point of catalytic activity. These catalysts may be used alone and may be used together two or more sorts.

[0076] Although an addition in particular of a catalyst is not limited, in order to have sufficient hardenability and to hold down cost of a hardenability constituent comparatively low a minimum of a desirable addition, (beta) as opposed to 1 mol of SiH groups of an ingredient — 10^{-8} mol — are 10^{-6} mol more preferably

and a maximum of a desirable addition receives 1 mol of SiH groups of an ingredient (beta) — 10^{-1} mol — it is 10^{-2} mol more preferably.

[0077] It is possible to use a co-catalyst together for the above-mentioned catalyst, and as an example The Lynn system compounds, such as triphenyl phosphine, Amine system compounds, such as sulfur-maleate, 2-diester system compound, and a 2-hydroxy-2-methyl-1-butyne, and a simple substance, and triethylamine, etc. are mentioned. a minimum [as opposed to / although an addition in particular of a co-catalyst is not limited / 1 mol of hydrosilylation catalysts] of a desirable addition — 10^{-2} mol — it is 10^{-1} mol more preferably — a maximum of a desirable addition — 10^{-2} mol — it is 10^{-1} mol more preferably.

[0078] Although various methods can be taken as the method of mixing of an organic compound which contains a carbon-carbon double bond which has a SiH group in a case of making it react, and reactivity in [at least two] one molecule, an ingredient (beta), and a catalyst. A method of mixing ***** (beta) for what mixed a catalyst to an organic compound which contains a carbon-carbon double bond which has a SiH group and reactivity in [at least two] one molecule is preferred. Control of a reaction is difficult in case of a method of mixing a catalyst into an organic compound which contains a carbon-carbon double bond which has a SiH group and reactivity in [at least two] one molecule, and a mixture of an ingredient (beta). (beta) Since it has moisture and reactivity which an ingredient is mixing under existence (beta) of a catalyst when taking a method of mixing an organic compound which contains a carbon-carbon double bond which has a SiH group and reactivity in what mixed a catalyst with an ingredient in [at least two] one molecule, it may deteriorate.

[0079] Although many things can be set up as reaction temperature, 30 ** of minimums of a desirable temperature requirement are 50 ** more preferably in this case, and 200 ** of maximums of a desirable temperature requirement are 150 ** more preferably. It is not practical if reaction time for making it fully react will become long if reaction temperature is low, and reaction temperature is high. Although a reaction may be performed at a fixed temperature, a multi stage story or per-continuum temperature may be changed if needed.

[0080] A pressure of reaction time and reaction time can also be set up variously if needed.

[0081] A solvent may be used in the case of a hydrosilylation reaction. A solvent which can be used is not what is limited especially unless a hydrosilylation reaction is checked. If it illustrates concretely, hydrocarbon system solvents, such as benzene, toluene, hexane, and heptane, Halogen system solvents, such as ketone solvent [such as ether system solvents, such as a tetrahydrofuran 1, 4-dioxane, 1,3-dioxolane and diethylether, acetone, and methyl ethyl ketone], chloroform, methylene chloride, 1, and 2-dichloroethane, can be used conveniently. A solvent can also be used as two or more kinds of mixed solvents. As a solvent, toluene, a tetrahydrofuran, 1,3-dioxolane, and chloroform are preferred. The amount of solvents to be used can also be set up suitably.

[0082] In addition, various additive agents may be used for the purpose of controlling reactivity etc. [0083] After making an organic compound and an ingredient (beta) which contain a carbon-carbon double bond which has a SiH group and reactivity in [at least two] one molecule react. An organic compound or, and (beta), an ingredient which contain a carbon-carbon double bond which has a solvent or, and an unreacted SiH group and reactivity in [at least two] one molecule are also removable. Since the (A) ingredient obtained does not have volatile matter content, it is hard to produce a problem of a void by volatilization of volatile matter content, and a crack by removing such volatile matter content in hardening with the (B) ingredient. As a method of removing, processing by activated carbon, aluminum silicate, silica gel, etc. besides for example, decompression devolatilization, etc. are mentioned. When carrying out decompression devolatilization, processing at low temperature is preferred. A maximum of a desirable temperature in this case is 100 **, and is 60 ** more preferably. If it processes at an elevated temperature, it will be easy to be accompanied by deterioration of thickening etc.

[0084] As an example of the (A) ingredient which is an organic compound and a reactant of an ingredient (beta), which contain a carbon carbon double bond which has above SiH groups and reactivity in [at least two] one molecule, A reactant of bisphenol A diaryl ether and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, A reactant of divinylbenzene and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, A reactant of a dicyclopentadiene and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, A reactant of triallyl isocyanurate, a

reactant of 1,3,5,7-tetramethyl cyclooctetrasiloxane and diaryl monoglycidyl isocyanurate, and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, etc. can be mentioned. A compound which has a SiH group which are ((B)) Ingredient), next the (B) ingredient is explained.

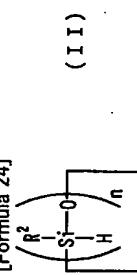
[0085] The (B) ingredient of this invention is a compound which contains at least two SiH groups in one molecule.

[0086] (B) It is a compound which there will be no restriction especially if it is a compound which contains at least two SiH groups in one molecule about an ingredient, for example, is indicated to international publication WO96/15194, and what has at least two SiH groups in one molecule can be used.

[0087] From a field of availability, it is following General formula (II) further among these from a viewpoint that a chain and/or annular organopolysiloxane which have at least two SiH groups are preferred in one molecule, and compatibility with the (A) ingredient is good for it.

[0088]

[Formula 24]



(among a formula, R² expresses the organic group of the carbon numbers 1-6, and n expresses the number of 3-10) — the annular organopolysiloxane which is expressed and which has at least two SiH groups in one molecule is preferred.

[0089] As for substituent R² in the compound expressed with general formula (II), it is preferred that it is what comprises C, H, and O, it is more preferred that it is a hydrocarbon group, and it is still more preferred that it is a methyl group.

[0090] As a compound expressed with general formula (II), it is preferred from a viewpoint of acquisition ease that it is 1, 3, 5, and 7-tetramethyl cyclotetrasiloxane.

[0091] (B) Although restrictions in particular do not have a molecular weight of an ingredient and arbitrary things can use it conveniently, from a viewpoint of being easier to reveal mobility, the thing of low molecular weight is used preferably. Specifically the thing of 50-100,000 has a preferred molecular weight, the thing of 50-1,000 is more preferred, and the thing of 50-700 is still more preferred.

[0092] (B) Independent, two or more sorts of things are mixed, and an ingredient can be used.

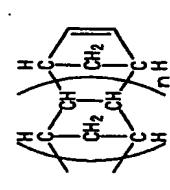
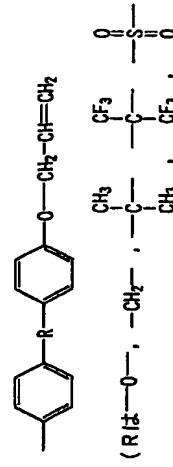
[0093] (A) From a viewpoint of having an ingredient and good compatibility, and a viewpoint of being hard to produce a problem of outgas from encapsulant that the volatility of the (B) ingredient can become low. (B) An organic compound (alpha) which contains a carbon-carbon double bond in which an ingredient has a SiH group and reactivity in [one or more] one molecule, it is preferred that it is a compound which can obtain a chain and/or annular polyorganosiloxane (beta) which has at least two SiH groups by the ability to carry out a hydrosilylation reaction in one molecule.

(alpha) The ingredient (alpha) can also use here the same thing (alpha 1) as a SiH group and an organic compound which contains a carbon-carbon double bond which has reactivity in [at least two] one molecule which are the above-mentioned (A) ingredients. (alpha 1) Crosslinking density of a hardened material which will be obtained if an ingredient is used becomes high, and dynamics intensity serves as reliable high encapsulant easily.

[0094] In addition, an organic compound (alpha 2) which contains a carbon-carbon double bond which has a SiH group and reactivity in [one] one molecule can also be used. (alpha 2) A hardened material which will be obtained if an ingredient is used serves as low elasticity easily, and serves as reliable encapsulant easily by low stress.

(alpha 2) Especially if it is an organic compound which contains as an ingredient a carbon-carbon double bond which has a SiH group and reactivity in [one] one molecule, will not be limited, but (alpha 2). (ingredient) (B) In a point that the (A) ingredient and compatibility become good in an ingredient, it is preferred that it is what does not include siloxane units (Si—O—Si) like polysiloxane organicity block copolymer or a polysiloxane organicity graft copolymer as a compound, and contains only C, H, N, O, S, and halogen as a composing element.

$\left[-\text{CH}-\text{CH}_2-\right]_n-\text{CH}_2-\text{CH}=\text{CH}_2$
(n は5≤ n ≥2を満足する数を表す。)



less than 150 **, and it is most preferred that it is not less than 170 **. It can ask for glass-transition temperature as a temperature tandeita indicates the maximum to be in dynamic viscoelasticity measurement.

[0113][alpha 2] In a point that the heat resistance of a hardened material obtained becomes high as an ingredient, it is preferred that it is a hydrocarbon compound. In this case, a minimum of a desirable carbon number is 7 and a maximum of a desirable carbon number is 10.

[0114][alpha 2] As an ingredient, it may have other reactant groups. As a reactant group in this case, an epoxy group, an amino group, a radical polymerization nature unsaturation group, a carboxyl group, an isocyanate group, hydroxyl, alkoxy silyl groups, etc. are mentioned. When it has these functional groups, intensity of a hardened material obtained by the adhesive property of a hardenable constituent obtained becoming high easily becomes high easily. From a point that an adhesive property can become higher, an epoxy group is preferred among these functional groups. In a point that the heat resistance of a hardened material obtained becomes high easily, it is preferred to average a reactant group and to have in [one or more] one molecule. Specifically, monoallyl diglycidyl isocyanurate, allyl glycidyl ether, allyloxy ethyl methacrylate, allyloxy ethyl acrylate, vinyltrimetoxysilane, etc. are mentioned.

[0115] A single thing may be used as above (alpha 2) ingredients, and it may use combining two or more things.

(beta) An ingredient is a chain and/or annular polyorganosiloxane which has at least two SiH groups in one molecule (beta). (ingredient)

[0116] concrete — for example [0117]

[Formula 32]

[0110][alpha 2] As a concrete example of an ingredient, a propene, 1-butene, 1-pentene, 1-hexene, 1-heptane, 1-octene, 1-nonene, 1-decene, 1-dodecene, 1-undecene, Lini Allen by an Idemitsu petrochemical company, 4,4-dimethyl-1-pentene, A 2-methyl-1-hexene, a 2,3,3-trimethyl 1-butene, Chain aliphatic hydrocarbon system compounds, such as 2, 4, and 4-trimethyl 1-pentene. A cyclohexene, a methylcyclohexene, methylenecyclohexane, NORUBORUNIREN, ethylenecyclohexane, vinylcyclohexane, Annular aliphatic hydrocarbon system compounds, such as camphene, Carene, alpha pinene, and beta pinene. Styrene, alpha methylstyrene, indene, phenylacetylene, 4-ethynyltoluene, Aromatic hydrocarbon system compounds, such as allylbenzene and a 4-phenyl-1-butene, Aliphatic series system compounds, such as allyl ether [such as alkyl allyl ether and allylphenyl ether], glycerin monoallyl ether, ethylene glycol monoallyl ether, and 4-vinyl-1,3-dioxolane 2-one, 1,2-dimethoxy-4-allylbenzene, Aromatic system compounds, such as o-allylphenol, monoallyl dibenzyl isocyanurate, Silicon compounds, such as substitution isocyanurate, such as monoallyl diglycidyl isocyanurate, vinyl trimetoxysilane, vinyltrimetoxysilane, and a vinylnaphenylsilane, etc. are mentioned. Polyether system resin, such as piece end arylation polyethylene oxide and piece end arylation polypropylene oxide, Polymer or oligomer etc. which has a vinyl group can be mentioned to piece ends, such as acrylic resin, such as hydrocarbon system resin, such as piece end arylation polyisobutylene, piece end arylation poly butyl acrylate, and piece end arylation polymethylmethacrylate.

[0111] A line or a letter of branching may be sufficient as structure, restrictions in particular do not have a molecular weight and it can use various things. In a point that viscosity of a mixture becomes low and a moldability becomes good easily although molecular weight distribution in particular does not have restriction, either, it is preferred that molecular weight distribution is three or less, it is more preferred that it is two or less, and it is still more preferred that it is 1.5 or less.

[0112][alpha 2] When glass transition temperature of an ingredient exists, there is no limitation in particular also about this, and various things are used, but. In a point that a hardened material obtained becomes tough easily, as for glass point transfer temperature, it is preferred that it is 100 ** or less, it is more preferred that it is 50 ** or less, and it is still more preferred that it is 0 ** or less. Poly butyl acrylate resin etc. are mentioned as an example of desirable resin. Conversely, in a point that the heat resistance of a hardened material obtained becomes high, as for glass-transition temperature, it is preferred that it is not less than 100 **, it is more preferred that it is not less than 120 **, it is still more preferred that it is not

- [0122] From acquisition ease etc., it is preferred that it is 1, 3, 5, and 7-tetramethyl cyclotetrasiloxane.
- [0123] A thing [a thing] described above and which are independent, or mixes two or more sorts of things, and is used is possible for an ingredient in some numbers (beta).

10^{-2} mol — it is 10 mol more preferably.

[0130] Although various methods can be taken as the method of mixing of an ingredient (alpha) in a case of making it react, an ingredient (beta), and a catalyst, a method of mixing ***** (beta) for what mixed a catalyst for an ingredient (alpha) is preferred. (alpha) Control of a reaction is difficult in case of a method of mixing catalyst into a mixture of an ingredient and an ingredient (beta). (beta) Since it has moisture and reactivity which an ingredient is mixing under existence (beta) of a catalyst when taking a method of mixing an ingredient (alpha) to what mixed a catalyst with an ingredient, it may deteriorate.

hydroxilation reaction of an ingredient (alpha) and the ingredient (beta) is carried out, a mixture of compounds containing the (B) ingredient of this invention may be obtained, but the (B) ingredient from there, it can use with a mixture and a hardenability constituent

[0125][alpha] The mixing ratio of an ingredient (alpha) in a case of carrying out the hydroxylatation reaction of an ingredient and the ingredient (beta), and an ingredient (beta). Although not limited in particular, when intensity of a hardened material by hydroxylatation with the (B) ingredient and the (A) ingredient which are obtained is considered, since a direction with many SiH groups of the (B) ingredient is preferred. It is preferred that a ratio with a total (Y) of a SiH group in an ingredient (beta) mixed with total (X) of a carbon-carbon double bond which has reactivity with a SiH group in an ingredient (alpha) generally mixed is $Y/X=2$, and it is more preferred that it is $Y/X=3$. From a point that compatibility with the (A) ingredient of the (B) ingredient becomes good easily, it is preferred that it is $10 > Y/X$ and it is more preferred that it is $100 > Y/X$.

is $5 > \gamma/\chi$.

[0126] A suitable catalyst may be used when carrying out the hydrosilylation reaction of an ingredient and the ingredient (*beta*). As a catalyst, the following can be used, for example. A thing which made carriers, such as a simple substance of platinum, alumina, silica, and carbon black, support solid platinum. A complex with chloroplatinic acid, chloroplatinic acid, alcohol, aldehyde, ketone, etc., Platinum-olefin complex (for example, it $\text{Pt}(\text{CH}_2=\text{CH}-\text{C}(\text{PPh}_3)_2)^2$ and $\text{Pt}(\text{CH}_2=\text{CH}_2)_2\text{Cl}_2$, Platinum-vinylsiloxane complex (for example, it $\text{Pt}(\text{ViMe}_2-\text{SiOSiMe}_2\text{Vi})_n$ and $\text{Pt}[(\text{MeVSiO})_4]^m$, a platinum-phosphine complex. (For example, $\text{Pt}(\text{PBU}_3)_4$, a platinum-phosphite complex (for example, Pt $[\text{P(OPh)}_3]^n \rightarrow [\text{P}(\text{POBu})_3]^4$ (among a formula, a methyl group and Bu express a butyl group, Vi expresses a vinyl group, Ph expresses a phenyl group as for Me, and n and m) An integer is shown. A platinum-hydrocarbon complex indicated in dicarbonyl dichloroplatinum, a curl SHUJETO (Karstedt) catalyst, U.S. Pat. No. 3159601 of Ashby, and the No. 3159662 specification, And a platinum alcohoblate catalyst indicated in a U.S. Pat. No. 3220972 specification of RAMORO (Lamoreaux) is mentioned. A platinum chloride-olefin complex indicated in a U.S. Pat. No. 3516946 specification of Modic

[0127] As an example of catalysts other than a platinum compound, RhCl(PPh)₃, RhAl₂O₃, RuCl₃, IrCl₃, FeCl₃, AlCl₃, PdCl₂ and 2H₂O, NiCl₂, TiCl₄, etc. are mentioned.

[0128] In these, chloroplatinic acid, a platinum-vinyl siloxane complex, etc. are preferred from a point of catalytic activity. These catalysts may be used alone and may be used together two or more sorts.

[0129] Although an addition in particular of a catalyst is not limited, in order to have sufficient hardenability and to hold down cost of a hardenability constituent comparatively low a minimum of a desirable addition, (beta) as opposed to 1 mol of SiH groups of an ingredient — 10^{-8} mol — are 10^{-6} mol more preferably and a maximum of a desirable addition receives 1 mol of SiH groups of an ingredient (beta) — 10^{-1} mol — it is 10^{-2} mol more preferably. Here [here] It is possible again to use a co-catalyst together for the above-mentioned catalyst. Amine system compounds, such as sulfur-systems compounds, such as sulfur of acetylene alcohol system compounds, such as 1, such as the Lynn system compounds, such as triphenyl phosphine, and dimethyl maleate, 2-diester system compound, and a 2-hydroxy-2-methyl-1-butyne, and a simple substance, and triethylamine, etc. are mentioned as an example. A minimum [as opposed to / although an addition in particular of a co-catalyst is not limited / 1 mol of hydrosilylation catalysts] of a desirable addition — 10^{-2} mol — it is 10^{-1} mol more preferably — a maximum of a desirable addition —

10^2 mol — it is 10 mol more preferably.

[0130] Although various methods can be taken as the method of mixing of an ingredient (alpha) in a case of making it react, an ingredient (beta), and a catalyst, a method of mixing ***** (beta) for what mixed a catalyst for an ingredient (alpha) is preferred. (alpha) Control of a reaction is difficult in case of a method of mixing a catalyst into a mixture of an ingredient and an ingredient (beta). (beta) Since it has moisture and reactivity which an ingredient is mixing under existence (beta) of a catalyst when taking a method of mixing an ingredient (alpha) to what mixed a catalyst with an ingredient, it may deteriorate.

[0131] Although many things can be set up as reaction temperature, 30 ** of minimums of a desirable temperature requirement are 50 ** more preferably in this case, and 200 ** of maximums of a desirable temperature requirement are 150 ** more preferably. It is not practical if reaction time for making it fully react will become long if reaction temperature is low, and reaction temperature is high. Although a reaction may be performed at a fixed temperature, a multi stage story or per-continuum temperature may be changed if needed.

[0132] A pressure of reaction time and reaction time can also be set up variously if needed.
[0133] A solvent may be used in the case of a hydrosilylation reaction. A solvent which can be used is not what is limited especially unless a hydrosilylation reaction is checked. If it illustrates concretely, hydrocarbon system solvents, such as benzene, toluene, hexane, and heptane, Halogen system solvents, such as ketone solvent [such as ether system solvents, such as a tetrahydrofuran 1, 4-dioxane, 1,3-dioxolane and diethyl ether, acetone, and methyl ethyl ketone,], chloroform, methylene chloride, 1, and 2-dichloroethane, can be used conveniently. A solvent can also be used as two or more kinds of mixed solvents. As a solvent, toluene, a tetrahydrofuran, 1,3-dioxolane, and chloroform are preferred. The amount

[0134] In addition, various additive agents may be used for the purpose of controlling reactivity etc. [0135] (alpha) After making an ingredient and an ingredient (beta) react, a solvent or/and an unreacted (alpha) ingredient or/, and (beta) an ingredient are also removable. Since the (B) ingredient obtained does not have volatile matter content, it is hard to produce a problem of a void by volatilization of volatile matter content, and a crack by removing such volatile matter content in hardening with the (A) ingredient. As a method of removing, processing by activated carbon, aluminum silicate, silica gel, etc. besides for example, decompression devolatilization, etc. are mentioned. When carrying out decompression devolatilization, processing at low temperature is preferred. A maximum of a desirable temperature in this case is 100 **, and is 60 ** more preferably. If it processes at an elevated temperature, it will be easy to be accompanied by deterioration of thickening etc.

[0136] As an example of the (B) ingredient which is a reactant of above ingredients (alpha) and ingredients (beta), A reactant of bisphenol A diaryl ether and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, A reactant of a vinylcyclohexene and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, A reactant of divinylbenzene and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, A reactant of a dicyclopentadiene and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, A reactant of triallyl isocyanurate and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, A reactant of diaryl monoglycidyl isocyanurate and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, A reactant of allyl glycidyl ether and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, A reactant of alpha methylstyrene, a reactant of 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane and monoallyl diglycidyl isocyanurate, and 1, 3, 5, and 7-tetramethyl cycloctetrasiloxane, etc. can be mentioned.

(Mixing of the (A) ingredient and the (B) ingredient) About combination of the (A) ingredient and the (B) ingredient, various combination of things quoted as an example of a thing quoted as an example of the (A) ingredient, and those various mixtures / (B) ingredient and those various mixture ** can be mentioned.

[Q137] (A) In a ratio [as opposed to / the mixing ratio of an ingredient and the (B) ingredient is not limited especially unless required intensity is lost, but / number (X) of a carbon-carbon double bond in the (A) ingredient of the number of SiH groups in the (B) ingredient (Y)], a minimum of a desirable range — $Y/X \geq 0.3$ — more — desirable — $Y/X > 0.5$ — it is $Y/X > 0.7$ still more preferably — a maximum of a desirable range — $3 > Y/X$ — more — desirable — $2 > Y/X$ — it is $1.5 > Y/X$ still more preferably. When it shifts, sufficient intensity is not obtained or it becomes easy to carry out heat deterioration from a desirable range

(C) Ingredient A hydroxylating catalyst which is next the (C) ingredient is explained.

not be limited, but. For example, a thing which made carriers, such as a simple substance of platinum, alumina, silica, and carbon black, support solid platinum. A complex with chloroplatinic acid, chloroplatinic acid, alcohol, aldehyde, ketone, etc., Platinum-vinyl siloxane complex (for example, it Pt(CH₂=CH₂)₂Cl₂, Platinum-vinyl siloxane complex (for example, it Pt(CH₂=CH₂)₂-SiOSiMe₂-Vi)-n and) Pt[(MeViSiO)₄]_m, a platinum-phosphine complex.. [For example, Pt(PPh₃)₄, Pt(PtVMe₂-SiOSiMe₂-Vi)-n and) Pt[(MeViSiO)₄]_m, a platinum-phosphine complex.. [For example, Pt[P(OPh)₃]₄ and] Pt[P(OBu)₃]₄ (among a formula, a methyl phosphite complex (for example, Pt[P(OPh)₃]₄ and] Pt[P(OBu)₃]₄ (among a formula, a methyl group and Bu express a butyl group, Vi expresses a vinyl group, Ph expresses a phenyl group as for Me, and n and m show an integer.) dicarbonyl dichloroplatinum, and a cur SHUTE TO (Karstedt) catalyst. A platinum alcoholate catalyst indicated in a platinum-hydrocarbon complex indicated in U.S. Pat. No. 3159601 of Ashby (Ashby) and the No. 3159662 specification and a U.S. Pat. No. 3220972 specification of RAMORO (Lamoreaux) is mentioned. A platinum chloride-olefin complex indicated in a U.S. Pat. No. 3516946 specification of Modic (Modic) is also useful in this invention.

[0139]As an example of catalysts other than a platinum compound, RhCl(PPh₃)₃, RhCl₃, RhAl₂O₃, RuCl₃, IrCl₃, FeCl₃, AlCl₃, PdCl₂and2H₂O, NCl₂, TiCl₄, etc. are mentioned.

[0140]In these, chloroplatinic acid, a platinum-olefin complex, a platinum-vinyl siloxane complex, etc. are preferred from a point of catalytic activity. These catalysts may be used alone and may be used together two or more sorts.

[0141]Although an addition in particular of a catalyst is not limited, in order to have sufficient hardenability and to hold down cost of a hardenability constituent comparatively low a minimum of a desirable addition, (B) as opposed to 1 mol of SiH groups of an ingredient — 10⁻⁸ mol — are 10⁻⁶ mol more preferably and a maximum of a desirable addition receives 1 mol of SiH groups of an ingredient (beta) — 10⁻¹ mol — it is 10⁻² mol more preferably.

[0142]It is possible to use a co-catalyst together for the above-mentioned catalyst, and as an example The Lynn system compounds, such as triphenyl phosphine, Amine system compounds, such as 1, such as dimethyl maleate, 2-diester system compound, and a 2-hydroxy-2-methyl-1-butyne, and a simple substance, and triethylamine, etc. are mentioned. a minimum [as opposed to / although an addition in particular of a co-catalyst is not limited / 1 mol of hydrostabilization catalysts] of a desirable addition — 10⁻² mol — it is 10⁻¹ mol more preferably — a maximum of a desirable addition — 10⁻² mol — it is 10 mol more preferably. An adhesion grant agent which are ((D) Ingredient), next the (D) ingredient of this invention is explained.

[0143]Everything but adhesives generally used as an adhesion grant agent, for example, various coupling agents. An epoxy compound, phenol resin, coumarone-indene resin, rosin ester resin, terpene phenol resin, a alpha-methylstyrene vinyltoluene copolymer, polyethylmethylstyrene, aromatic polyisocyanate, etc. can be mentioned.

[0144]A silane coupling agent is mentioned as a coupling agent. It will not be limited especially if it is a compound which has respectively an organic group, an existing reactant functional group, and at least one silicon group of hydrolysis nature in a molecule as a silane coupling agent. As an organic group and an existing reactant basis, an epoxy group from a point of handling nature, an methacrylic group, At least one functional group chosen from an acrylic group, an isocyanate group, a vinyl group, and a carbamate group is preferred, and an epoxy group, an methacrylic group, and especially an acrylic group are preferred from a reactant point. As a silicon group of hydrolysis nature, a silyl group is preferred from a reactant point.

[0145]As a desirable silane coupling agent, 3-(glycidoxypyropyltrimetoxysilane, 3-glycidoxypyropyltrimetoxysilane, 2-(3, 4-epoxycyclohexyl) ethyltrimetoxysilane, The alkoxy silane which has epoxy functional groups, such as 2-(3, 4-epoxycyclohexyl) ethyltrimetoxysilane : 3-methacryloxy propyl trimetoxysilane, 3-methacryloxypropyl trimetoxysilane, 3-acryloxypropyltrimetoxysilane, The alkoxy silane which has an methacrylic group or acrylic groups, such as meta-KURIROKISHI methyl trimetoxysilane, acryloxy methyl trimetoxysilane, and acryloxy methyl trimetoxysilane, can be illustrated.

[0146]Although many things can be set up as an addition of a silane coupling agent, minimums of a

desirable addition to [ingredient + (B) (A) Ingredient] 100 weight section are 0.5 weight sections more preferably 0.1 weight sections, and maximums of a desirable addition are 25 weight sections more preferably 50 weight sections. If there are few additions, the adhesive improvement effect will not appear, but if there are many additions, it may have an adverse effect on hardened material physical properties.

[0147]As an epoxy compound, for example A novolak phenol type epoxy resin, A biphenyl type epoxy resin, dicyclopentadiene type epoxy resin, Bisphenol F diglycidyl ether, bisphenol A diglycidyl ether, bisphenol A diglycidyl isocyanurate, diaryl monoglycidyl isocyanurate, etc. can be mentioned.

[0148]Although many things can be set up as an addition of an epoxy compound, minimums of a desirable addition to [ingredient + (B) (A) Ingredient] 100 weight section are three weight sections more preferably 1 weight section, and maximums of a desirable addition are 25 weight sections more preferably 50 weight sections. If there are few additions, the adhesive improvement effect will not appear, but if there are many additions, it may have an adverse effect on hardened material physical properties.

[0149]These coupling agents, a silane coupling agent, an epoxy compound, etc. may be used alone, and may be used together two or more sorts.

[0150]A compound which contains an epoxy group in intramolecular in a point that the adhesive grant effect is high among these adhesion grant agents is preferred. The 3-glycidoxypyropyltrimetoxysilane above-mentioned as an example of a compound containing an epoxy group, 3-glycidoxypyropyltriethoxysilane, 2-(3, 4-epoxycyclohexyl) ethyltrimetoxysilane, The alkoxy silane which has epoxy functional groups, such as 2-(3,4-epoxycyclohexyl) ethyltrimetoxysilane. A novolak phenol type epoxy resin, a biphenyl type epoxy resin, Dicyclopentadiene type epoxy resin, bisphenol F diglycidyl ether, Bisphenol A diglycidyl ether, 2,2-bis(4-glycidylxyl cyclohexyl)propane, 3,4-epoxycyclohexylmethyl 3,4-epoxy cyclohexane carbo KUSHIRETO. Vinylcyclohexene dioxide, 2-(3,4-epoxycyclohexyl)-5,5-spiro[3,4-cyclopropanedicarboxylic glycidyl ester, tritylglycidyl isocyanurate, monooaryl diglycidyl isocyanurate, Epoxy compounds, such as diaryl monoglycidyl isocyanurate, etc. are mentioned.

[0151]In order to heighten an effect of a coupling agent or an epoxy compound in this invention, a silanol condensation catalyst which is next the (E) ingredient is explained.

[0152]The aluminum chelate M (the Kawarai Fine Chemicals make, alkyl acetacetate aluminium diisopropoxide, sec-butoxide : Ethylacetacetate aluminium diisopropoxide, aluminum tris (ethylacetacetate). The aluminum chelate M (the Kawarai Fine Chemicals make, alkyl acetacetate aluminium diisopropoxide). Aluminum chelate, such as aluminum tris (acetylacetone) and an aluminum monooacetyl acetone screw (ethylacetacetate), can be illustrated, and aluminum chelate is more preferred from a point of handling nature. As a titanium system compound used as a silanol condensation catalyst, Titanium chelate, such as tetraalkoxy titanium tetra acetylacetonato, such as tetrasopropoxy titanium and tetrabutoxytitanium, A general titanate coupling agent which has residue, such as oxyacetic acid and ethylene glycol, can be illustrated.

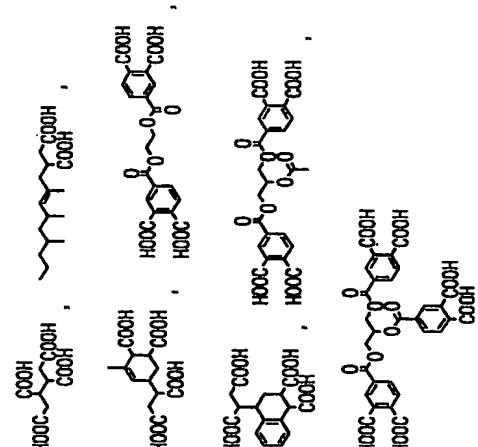
[0153]Although various the amount of [in case used of using a silanol condensation catalyst] can be set up. A minimum of a desirable addition to a coupling agent or/, and epoxy compound epoxy compound 100 weight section is one weight section more preferably 0.1 weight sections, and maximums of a desirable addition are 30 weight sections more preferably 50 weight sections. If there are few additions, the adhesive improvement effect will not appear, but if there are many additions, it may have an adverse effect on hardened material physical properties.

[0154]These silanol condensation catalysts may be used alone and may be used together two or more sorts.

((F) ingredient) The carboxylic acid or/, and the acid anhydrides which are next the (F) ingredients are

explained. [0154] In order to heighten an effect of a compound which contains an epoxy group in this invention, carbonylic acid or/ and acid anhydrides can be used, and adhesive improvement and/ or stabilization is especially possible. Although not limited especially as such carboxylic acid and acid anhydrides, [0155]

Formula 35] $\text{HOOC}-\text{CH}_2-\text{COOH}$



2-ethylhexanoic acid, cyclohexane carboxylic acid, cyclohexanedicarboxylic acid, Methylcyclohexane dicarboxylic acid, tetrahydrophthalic acid, methyl tetrahydrophthalic acid, Methyl himic acid, norbornene dicarboxylic acid, hydrogenation methyl NAJIKUU acid, Maleic acid, acetylene dicarboxylic acid, lactic acid, trimellitic maleic acid, citrate, tartaric acid, benzoic acid, hydroxybenzoic acid, cinnamic acid, phthalic acid, naphthalene carboxylic acid, naphthalene dicarboxylic acid and independent acid, pyromellitic acid, naphthalene carboxylic acid, naphthalene dicarboxylic acid and independent acid. Compound 4b-1 and compound 4b-2 are substituted with a tert-

ure 1, or a compound aceto anhydride is mentioned.

01[156]A thing containing a carbon-carbon double bond which has hydroxylation reactivity among these carboxylic acid or, and acid anhydrides, and has a SiH group and reactivity in a point of being hard to spoil the physical properties of a hardened material in which it oozes from a hardened material and the impossibility of ~~it~~ is acquired few is preferred as desirable carboxylic acid or, and acid anhydrides — for

Example [0157] *is acquiesce*

Example 3-6] $\text{H}_3\text{C}-\text{CH}(\text{CH}_3)-\text{COOH}$ (n は0～30の数を表す。)

[tetrahydrophthalic acid, methyl tetrahydrophthalic acid and independent [those], or a compound acid anhydride as mentioned.]

[0158] Although various the amount of [in case used of using carboxylic acid or/, and acid anhydrides] can be set up. A minimum of a desirable addition to a coupling agent or/, and epoxy compound epoxy compound 100 weight section is one weight section more preferably 0.1 weight sections, and maximums of desirable addition are ten weight sections more preferably 50 weight sections. If there are few additions, the adhesive improvement effect will not appear, but if there are many additions, it may have an adverse effect on bonded material physical properties.

[0159] These carboxylic acid or/and acid anhydrides may be used alone, and they may be used together with or more sorts in a variety of physical properties.

(Mixing) Although various methods can be taken as the method of mixing of the (A) ingredient, the (B) ingredient, the (C) ingredient, and the (D) ingredient, In a point that the storage stability of an intermediate material of a sealing agent becomes good easily, what mixed the (C) ingredient and the (D) ingredient for mixing the (A) ingredient, and a method of mixing the (B) ingredient are preferred. (B) When taking a method of mixing the (A) ingredient to what mixed the (C) ingredient or, and the (D) ingredient for an ingredient, (C) Since the (B) ingredient has that of moisture in environment or, and the (D) ingredient, and reactivity under ingredient existence or/and nonexistence, it may deteriorate in the storage middle class.

(Additive agent)

(Concrete retarder) A concrete retarder can be used in order to adjust the reactivity of a hydroxylated reaction in the purpose of improving the preservation stability of #*, or a manufacturing process to encapsulant of this invention. As a concrete retarder, a compound, an organophosphorus compound, an organic sulfur compound, a nitrogen containing compound, a tin series compound, organic peroxide, etc. containing aliphatic unsaturated bonds are mentioned, and these may be used together. As a compound containing aliphatic unsaturated bonds, propargyl alcohol, enyne alcohol, and ester maleate are illustrated. As an organophosphorus compound, Tori ORGANOGANO phosphoretted hydrogen, JIORUGANO phosphoretted hydrogen, ORGANOGANO Foss John, and trio luganot phosphite are illustrated. As an organic sulfur compound, the ORGANOGANO mercaptans, JIORUGANO sulfides, hydrogen sulfide, benzothiazole, a benzothiazole disulfide, etc. are illustrated. As a nitrogen containing compound, ammonia, the 1-3rd class alkylamine, arylamines, urea, hydrazine, etc. are illustrated. As a tin series compound, first tin of halogenation 2 hydrate, the first tin of carboxylic acid, etc. are illustrated. As organic peroxide, di-t-butylperoxide, dicumyl peroxide, benzoyl peroxide, parbenzoic acid t-butyl, etc. are illustrated. [0160] Delay activity is good among these concrete retarders, and a benzothiazole, thiazole, dimethylmalate, and 3-hydroxy-3-methyl-1-butyne is preferred from a viewpoint that raw material availability is good. [0161] a minimum of a desirable addition to 1 mol of hydroxylated catalysts used although various additions of a concrete retarder can be set up — 10^{-1} mol — it is 1 mol more preferably — a maximum of a desirable addition — 10^{-3} mol — it is 50 mol more preferably.

[0162]These concrete retarders may be used alone and may be used together two or more sorts. (Adhesive improving agent) In order to heighten the adhesive grant effect further in this invention, a source compound of a silanol can be used further and adhesive improvement and/or stabilization is possible again. As such a source of a silanol, alkoxy silane, such as, silanol compounds, such as a triphenylsilanol and a diphenyldihydroxysilane, diphenyldimethoxysilane, a tetramethoxy silane, and methyl trimetoxysilane, can be mentioned, for example.

[0163]Although various the amount of [in case used of using a source compound of a silanol] can be set up. A minimum of a desirable addition to a coupling agent or, and epoxy compound epoxy compound 100 weight section is one weight section more preferably 0.1 weight sections, and maximums of a desirable addition are 30 weight sections more preferably 50 weight sections. If there are few additions, the adhesive improvement effect will not appear, but if there are many additions, it may have an adverse effect on hardened material physical properties.

[0164]These source compounds of a silanol may be used alone, and may be used together two or more

(Thermosetting resin) It is the purpose of reforming the characteristic to encapsulant of this invention, and
so on.

it is also possible to add various thermosetting resin. As thermosetting resin, although an epoxy resin, a cyanate ester resin, phenol resin, polyimide resin, urethane resin, a bismaleimide resin, etc. are illustrated, it is not limited to this. A viewpoint of excellency in the practical use characteristics, such as an adhesive property, to an epoxy resin is [among these] preferred.

[0163] As an epoxy resin, for example A novolac phenol type epoxy resin, A diglycidyl type epoxy resin, dicyclopentadiene type epoxy resin, Bisphenol F diglycidyl ether, bisphenol A diglycidyl ether, 2,2'-bis(4-glycidyloxy cyclohexyl)propane, 3,4-epoxy cyclohexylmethoxy 3,4-epoxy cyclohexane carbo KISHIRETO, Vinylcyclohexene dioxide, 2-(3,4-epoxycyclohexyl)-5,5-spiro[3,4-epoxy cyclohexane]-1,3-dioxane, A bis[(3,4-epoxycyclohexyl)horse mackerel peat, screw 1,2 cyclopropanedimethoxy, glycidyl ester, Triglycidyl isocyanurate, monoglycidyl isocyanurate, What softens epoxy resins, such as diaryl monoglycidyl isocyanurate, with aliphatic acid anhydrides, such as hexahydro phthalic anhydride, methyl methylethyleneglycol anhydride, trialkyl tetrahydro phthalic anhydride, and a hydrogenation methyl

methacrylic group or acrylic groups, such as meta-KURIROKISHI methyl triethoxysilane, acryloxy methyl trimetoxysilane, and acryloxy methyl triethoxysilane, can be illustrated.

[0182] In addition, a method of adding a filler is mentioned. For example, a hydrolytic silane monomer or oligomer, such as alkoxy silane, and halogenation Silang, A method of adding to a constituent of this invention, making an alkoxide of metal, such as titanium and aluminum, reed ROKISHIDO, a halogenide, etc. reacting in a constituent or a partial reactant of a constituent, and making a filler generating in a constituent can also be mentioned.

[0183] From a viewpoint that are hard to check a hardening reaction among the above fillers, and the reduction effect of a coefficient of linear expansion is large, a silica system filler is preferred.

[0184] In a point that perviousness to a slit of a sealing agent becomes good easily as mean particle diameter of a filler, it is preferred that it is 10 micrometers or less, and it is more preferred that it is 5 micrometers or less.

[0185] If a particle with a particle diameter of not less than 50 micrometers of a filler carries out comparatively, in a point that pervousness to a slit of a sealing agent becomes good easily, it is preferred that it 1 or less % of the weight, and it is more preferred that it is 0.1 or less % of the weight.

[0186] About particle size distribution of a filler, as a filler of the conventional sealing agents, such as an epoxy system, use or/, and a thing proposed are begun, and various setting out of it can be carried out. For example, it may be made for a particle (15 % of the weight or more and 1 micrometer or less) to be 3 % of the weight or more in a not less than 24-micrometer particle.

[0187] A rate of a with mean particle diameter of a filler and a particle diameter [of a filler] of not less than 50 micrometers particle can be measured using a laser method micro track grading analysis meter.

[0188] Also with specific surface area of a filler, as a filler of the conventional sealing agents, such as an epoxy system, use or/, and a thing proposed are begun, and various setting out of it can be carried out. For example, more than $4\text{ m}^2/\text{g}$ can set up below $4\text{ m}^2/\text{g}$ and below $10\text{ m}^2/\text{g}$ arbitrarily.

[0189] Specific surface area can be measured with a BET adsorption method mono-SOBU surface area measuring instrument.

[0190] Also with a vitrification rate of a filler, as a filler of the conventional sealing agents, such as an epoxy system, use or/, and a thing proposed are begun, and various setting out of it can be carried out. For example, it can set up arbitrarily not less than 97 etc.% etc.

[0191] As shape of a filler, it is preferred that it is a spherical filler from a viewpoint to which viscosity of a sealing agent becomes low easily.

[0192] A filler may be used alone and may be used together two or more sorts.

[0193] Although an addition in particular of a filler is not limited, the reduction effect of a coefficient of linear expansion is high, and — encapsulant — mobility — being good — saying — a viewpoint — from — it is desirable — an addition — a minimum — all — encapsulant — inside — 30 — % of the weight — more — desirable — 50 — % of the weight — it is — it is desirable — an addition — a maximum — all — encapsulant — inside — 80 — % of the weight — more — desirable — 70 — % of the weight — it is . (Antiaaging agent) An antiaaging agent may be added to encapsulant of this invention. As an antiaaging agent, an antiaaging agent generally used, for example, citrate and phosphoric acid, a sulfur-systems antaging agent, etc. are mentioned. As a sulfur-systems antaging agent, mercaptans, salts of mercaptan, Sulfide carboxylate and the sulfides containing hindered phenol system sulfides. Polysulfide, dithiocarboxylic acid salts, thiourea, thio phosphate, a sulfonium compound, thioaldehydes, thiolketones, mercaptal, mercaptol, monothio acid, polythio acid, thioamides, and sulfoxides are mentioned.

[0194] These antiaaging agents may be used alone and may be used together two or more sorts. (Radical inhibitor) Radical inhibitor may be added to encapsulant of this invention. As radical inhibitor, for example 2,6-di-t-butyl-3-methyl phenol (BHT), A 2,2'-methylene-screw (4-methyl-6-t-butylphenol), Phenol system radical inhibitor, such as tetrakis (methylene-3 (3,5-di-t-butyl-4-hydroxyphenyl) propionate) methane, Amino system radical inhibitor, such as phenyl-beta-naphthylamine, alpha-naphthylamine, the N,N'-second butyl-p-phenylene diamine, phenothiazin, and N,N'-diphenyl-p-phenylene diamine, etc. are mentioned.

[0195] These radical inhibitor may be used alone and may be used together two or more sorts. (Ultraviolet ray absorbent) An ultraviolet ray absorbent may be added to encapsulant of this invention. As an ultraviolet ray absorbent, 2 (2-hydroxy-3,5-di-t-butylphenyl) benzotriazol, bis(2,2,6,6-tetramethyl 4-

piperidine)sebacate, etc. are mentioned, for example.

[0196] These ultraviolet ray absorbents may be used alone and may be used together two or more sorts. (In addition to this additive agent) In addition to this in encapsulant of this invention, use or/, and a thing proposed are begun as a filler of the conventional sealing agents, such as an epoxy system, Colorant, a release agent, fire retardant, a fire-resistant auxiliary agent, a surface-active agent, a defoaming agent, an emulsifier, A leveling agent, a crawling inhibitor, an ion trap agent, a thixotropic grant agent, A tackifier, a preservation stable improving agent, anti-ozoneant, light stabilizer, a thickener, In a range which does not spoil the purpose and an effect of this invention, a plasticizer, reactive diluent, an antioxidant, a heat stabilizing agent, an electro-conductivity applying agent, a spray for preventing static electricity, a radiation interception agent, a nucleating additive, the Lynn system peroxide decomposition agent, a physical-properties regulator, etc. can be added.

(Solvent) Encapsulant of this invention can also be dissolved and used for a solvent. If a solvent in particular that can be used is not limited and is illustrated concretely, Hydrocarbon system solvents, such as benzene, toluene, hexane, and heptane, a tetrahydrofuran, Halogen system solvents, such as ketone solvent [such as ether system solvents, such as 1, 4-dioxane, 1,3-dioxolane, and diethylether, acetone, methyl ethyl ketone, and methyl isobutyl ketone,], chloroform, methylene chloride, 1, and 2-dichloroethane, can be used conveniently.

[0197] As a solvent, toluene, a tetrahydrofuran, 1,3-dioxolane, and chloroform are preferred.

[0198] Although the amount of solvents to be used can be set up suitably, minimums of the desirable amount used to the hardenability constituent 1g to be used are 0.1mL, and maximums of the desirable amount used are 10mL An effect of using solvents, such as hypoviscosity—izing, if there is little amount used is hard to be acquired, and if there is much amount used, a solvent will remain into material and it will be easy to become problems, such as a heat crack, and it becomes in cost and disadvantageous, and industrial-utilizations value falls.

[0199] These solvents may be used alone and can also be used as two or more kinds of mixed solvents. (Encapsulant description) As encapsulant of this invention, as described above, can use a thing of various combination, but In a point that restoration nature to a slit is good, as viscosity of encapsulant, it is preferred in 23 ** that they are 1000 or less Pa-s, it is more preferred that they are 10 or less Pa-s, and they are less than 5.0 Pa-s — further — this — better — it is preferred that they are especially ** and 1.0 Pa-s or less, and it is preferred that it is especially 0.1 or less. It is preferred that it is below 10 Pa and s in 100 ** for the same reason, it is more preferred that it is 1.0 or less Pa-s, and it is still more preferred that it is 0.1 or less Pa-s.

[0200] Various things can be used also about the temperature dependence (thixotropy) of viscosity. [0201] Viscosity can be measured with E type viscosity meter.

[0202] It is preferred that penetration time to the 50-micrometer crevice at 23 ** is 600 or less seconds/cm as an infiltration speed to a crevice, and it is more preferred that it is 120 or less seconds/cm. It is preferred that penetration time to the 25-micrometer crevice at 23 ** is 600 or less seconds/cm. It is preferred that penetration time to the 50-micrometer crevice at 60 ** is 120 or less seconds/cm, and it is more preferred that it is 180 or less seconds/cm. It is preferred that penetration time to the 50-micrometer crevice at 60 ** is 120 or less seconds/cm, and it is more preferred that it is 60 or less seconds/cm. It is preferred that penetration time to the 25-micrometer crevice at 60 ** is 180 or less seconds/cm, and it is more preferred that it is 120 or less seconds/cm. It is preferred that penetration time to the 50-micrometer crevice at 100 ** is 60 or less seconds/cm, and it is more preferred that it is 30 or less seconds/cm. It is preferred that penetration time to the 25-micrometer crevice at 100 ** is 120 or less seconds/cm, and it is more preferred that it is 60 or less seconds/cm.

[0203] Penetration time to a crevice is measured by a following method. As shown in drawing 1, on a glass plate, separate an aluminum foil spacer (50 micrometers in thickness, or 25 micrometers) of two sheets 15 mm, and it is arranged in parallel. After loading a cover glass of 18-mm width so that it may straddle in the meantime, a glass plate, an aluminum foil spacer, and a cover glass are fixed with adhesive tape. Thus, space (15mmx18mmx50micrometer or 25 micrometers) is prepared with a glass plate, aluminum foil, and a cover glass. As shown in drawing 1, after settling this thing on a hot plate, adjusting to preset temperature, and hanging down encapsulant to one side of a crevice, time until encapsulant which permeated a 1-cm position from one of them reaches is measured, and it is considered as crevice penetration time.

[0204] Although it can set up arbitrarily about the hardenability of encapsulant, it is preferred that gel time at 120 ** is less than 120 seconds, and it is more preferred that it is less than 60 seconds. It is preferred

[0223] As electric contact, a node of a substrate and a cable, a node of a cable and a node of substrates, a node of a substrate and an element, a node of a cable and an element, etc. are mentioned. (Sealing method) A method of closing can also take various methods including use or, and a thing proposed as a sealing method of the conventional sealing agents, such as an epoxy system. For example, it can also close by casting, potting, dipping, a press, coating, or screen-stencil, and molding closure can also be carried out like a transfer mold. After carrying out dispensing, it can close also by a method (under-filling) of making it permeate a crevice.

[0224] Various processing can also be performed if needed at the time of closure. For example, processing etc. which deform encapsulant or encapsulant made to react in part with centrifugality, decompression, etc. for control of a void generated at the time of closure are also applicable, and it can also defoam, after closing.

[0225] Various pressure conditions at the time of closing can also be set up, and any method of ordinary pressure, decompression, and application of pressure can be applied. It is [being / where crevices, such as under-filling, are made to permeate / a case, and] sometimes effective to carry out by decompression to improve perviousness to a detailed part. Regularity may be sufficient as a pressure and it may change continuation or a stage target to a target with the passage of time if needed.

[0226] Various temperature in a case of closing can also be set up, a case where crevices, such as under-filling, are made to permeate, and a case where he would like to improve perviousness to a detailed part — warming — it is sometimes effective to carry out in the state. In this case, for example, temperature of 50 ** - 200 ** is applicable. Regularity may be sufficient as temperature and it may change continuation or a stage target to a target with the passage of time if needed.

(Example of encapsulant) Although a concrete example of encapsulant is given to below, encapsulant of this invention is not limited to this.

[0227] As encapsulant of a semiconductor, a capacitor, a diode, A light emitting diode, IC, LSI, a sensor, etc. Casting, potting, Encapsulant for closing by dipping, a transfer mold, coating, screen-stencil, etc. is mentioned. More specifically COB(s), such as a light emitting diode, IC, LSI, and a sensor, Potting encapsulants, such as COF and TAB, under-filling of a flip chip (a capillary tube flow type and a compression flow type). Encapsulant at the time of IC package mounting of BGA, CSP, etc. (under-filling for reinforcement), encapsulant for stacked IC, encapsulant for the wafer levels CSP, etc. can be mentioned. In addition, various protective films used for a semiconductor previous process, such as a passivation film, a junction coat film, and a buffer coat film, are also the examples of encapsulant of a semiconductor.

[0228] As encapsulant of electronic parts, a deflection plate, a light filter, a transistor of TFT, A protective coating agent of a transparent conducting film and a liquid crystal display, and encapsulant of a liquid crystal with which a cell was filled up, a protective coating agent of a solar cell, encapsulant of a lithium ion battery or a fuel cell, a protective coating agent of organic electroluminescence (electroluminescence), a light source for optical recording, and a coating agent of a photo detector and encapsulant — a protective coating agent of the electronic-parts circumference of a car and encapsulant are also mentioned further.

[0229] As encapsulant of an electronic circuit, a solder resist of rigid printed circuit board and flexible printed circuit board material and a build up board, a protective coating agent, etc. are mentioned.

[0230] As encapsulant of electric contact, contact protection (coating) agents, such as a substrate, an element and a substrate, a substrate and a substrate, and a cable, a junction coating agent, etc. are mentioned.

(Semiconductor device) A semiconductor device can be manufactured by closing a semiconductor by a method which was described above using encapsulant of this invention. In this case, what is necessary is to use it for a use which described encapsulant of this invention above, and just to manufacture a semiconductor device by a usual method.

[0231] A semiconductor device is a device containing various semiconductors, for example, generally DIP, QFP, SOP, TSOQ, PGA, CSP, BGA using PI resin, ceramics, BT resin, or FR4 grade several-kinds substrate. Calling [QFN, COB, COF, TAB, the wafer level CSP, a stacked package, BCC, MCM, SIP, etc.] various IC packages, a light emitting diode part article, an optical sensor section article and a substrate in which they were carried, a module, etc. are mentioned.

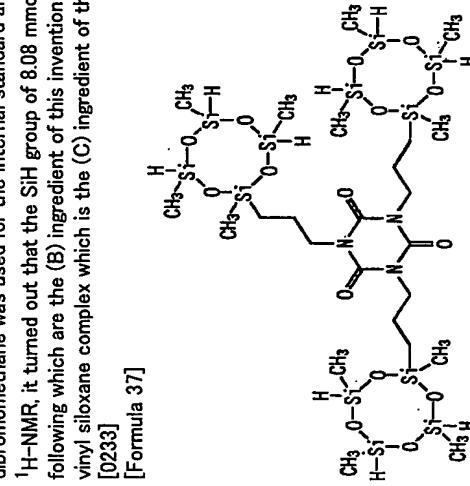
[0232] This invention is not limited by the following although the example and comparative example of [Example]

this invention are shown below.

(Synthetic example 1) Agitating equipment, the tap funnel, and the condenser tube were set to the 4 mouth flask of 5L. The toluene 1800g, 1, 3, and 5 and 1440 g of 7-tetramethyl cyclotetrasiloxane were put into this flask, and it heated and stirred in a 120 ** oil bath. The mixed liquor of 1.44 ml of xylene solutions (3wt% as platinum content) of 200 g of trially isocyanurate, 200g of toluene, and a platinum vinyl siloxane complex was dropped over 50 minutes. After warming and stirring the obtained solution as it was for 6 hours, decompression distilling off of unreacted 1,3,5,7-tetramethyl cyclotetrasiloxane and toluene was carried out. It turned out that, as for this thing, a part of SiH group of 1, 3, 5, and 7-tetramethyl cyclotetrasiloxane reacts to trially isocyanurate by $^1\text{H-NMR}$ (the reactant A is called). When 1,2-dibromomethane was used for the internal standard and the content of the SiH group was calculated by $^1\text{H-NMR}$, it turned out that the SiH group of 8.08 mmol/g is contained. Although output is a mixture, the following which are the (B) ingredient of this invention are contained as the main ingredients. The platinum vinyl siloxane complex which is the (C) ingredient of this invention is contained.

[0233]

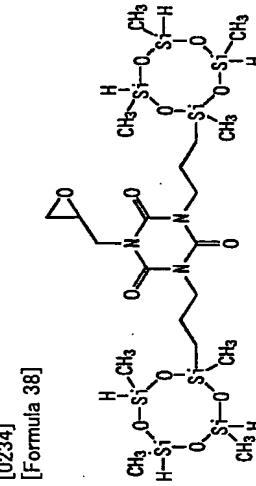
[Formula 37]



(Synthetic example 2) Agitating equipment, the tap funnel, and the condenser tube were set to the 4 mouth flask of 5L. The toluene 1380g, 1, 3, and 5 and 1356 g of 7-tetramethyl cyclotetrasiloxane were put into this flask, and it heated and stirred in a 105 ** oil bath. The mixed liquor of 1.36 ml of xylene solutions (3wt% as platinum content) of 300 g of diaryl monoglycidyl isocyanurate, 300g of toluene, and a platinum vinyl siloxane complex was dropped over 30 minutes. After warming and stirring the obtained solution as it was for 1 hour, decompression distilling off of unreacted 1,3,5,7-tetramethyl cyclotetrasiloxane and toluene was carried out. It turned out that, as for this thing, a part of SiH group of 1,3,5,7-tetramethyl cyclotetrasiloxane reacts to diaryl monoglycidyl isocyanurate by $^1\text{H-NMR}$ (the reactant B is called). When 1,2-dibromomethane was used for the internal standard and the content of the SiH group was calculated by $^1\text{H-NMR}$, it turned out that the SiH group of 8.73 mmol/g is contained. Although output is a mixture, the following which are the (B) ingredient of this invention are contained as the main ingredients. The platinum vinyl siloxane complex which is the (C) ingredient of this invention is contained.

[0234]

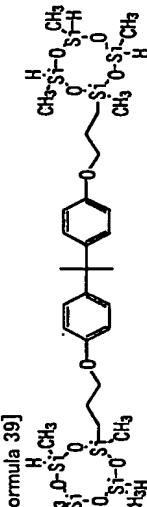
[Formula 38]



(Synthetic example 3) Agitating equipment, the condenser tube, and the tap funnel were set to the 4 mouth

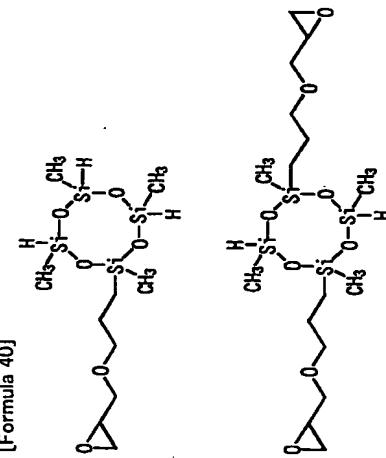
flask of 1L Xylene solution (3wt% as platinum content) 15.6microl of 150 g of toluene and a platinum vinyl siloxane complex, 1, 3 and 5, and 500 g of 7-tetramethyl cyclotetrasiloxane were added to this flask, and it was warmed and stirred at 70** in the oil bath. 64 g of bisphenol A diaryl ether was diluted with 40 g of toluene, and it was dropped from the tap funnel. It cooled radiationally after 60-minute stirring by the **, and 4.74 mg of benzothiazole was added. Decompression distilling off of unreacted 1,3,5,7-tetramethyl cyclotetrasiloxane and toluene was carried out. It turned out that, as for this thing, a part of SiH group of 1,3,5,7-tetramethyl cyclotetrasiloxane reacts to bisphenol A diaryl ether by ¹H-NMR (the reactant C is called). When 1,2-dibromomethane was used for the internal standard and the content of the SiH group was calculated by ¹H-NMR, it turned out that the SiH group of 7.51 mmol/g is contained. Although output is a mixture, the following which are the (B) ingredient of this invention are contained as the main ingredients. The platinum vinyl siloxane complex which is the (C) ingredient of this invention is contained.

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(Synthetic example 4) The magnetic stirring child, the tap funnel, and the condenser tube were set to the 4 mouth flask of 1L. The toluene 200g, 1, 3, and 5 and 200 g of 7-tetramethyl cycloctetrasiloxane were put into this flask, and it heated and stirred at 50 °C in the bottom oil bath of a nitrogen atmosphere. Xylene solution (3wt% as platinum content) 31.5microl. of the allyl glycidyl ether 95.0g and a platinum vinyl siloxane complex and the mixture of 50 g of toluene were dropped over 30 minutes from the tap funnel. After heating by the °C for 1 hour, decompression distilling off of unreacted 1, 3 and 5-tetramethyl cyclooctetrasiloxane, and the toluene was carried out. It turned out that a part of SiH group of 1, 3, 5, and 7-tetramethyl cyclooctetrasiloxane carries out the hydrosilylation reaction of this thing with allyl glycidyl ether by $^1\text{H-NMR}$ (the reactant D is called). When 1,2-dibromomethane was used for the internal standard and the content of the SiH group was calculated by $^1\text{H-NMR}$, it turned out that the SiH group of 6.63 mmol/g is contained. Although output is a mixture, the following which are the (B) ingredient of this invention are contained as the main ingredients. The platinum vinyl siloxane complex which is the (C) ingredient of this invention is contained.

• 10



(C) ingredient. [0237] Viscosity, crevice penetration time, the weight loss under hardening, gel time, and an adhesive property were measured using such encapsulants.

[1238] Such encapsulants were put into the ointment can so that it might become a depth of 3 mm, and it heated gradually by the curing conditions shown in the table, and the hardened material was obtained. *** elongation after fracture, T_G, and extraction ion content were measured using this hardened material.

[Tables 1]

(Examples 1–10, comparative example 1) Various kinds of organic compounds which contain the carbon–carbon double bond which has a SiH group and reactivity in [at least two] one molecule are used as a (A) ingredient. (B) Encapsulant was created by the combination shown in the table using reactant A–E communicated in the synthetic examples 1–5, 7, 20 in immediate using a platinum vinyl siloxane monomer as a

Viscosity: The viscosity in 23 ** was measured with E type viscosity meter.
[[0240]Crevise penetration time: The aluminum foil spacer was put with the glass plate of two sheets, and the crevice between 50-micrometer thickness 1.8 cm in length was created by 15-mm width like drawing. After settling this thing on the hot plate, adjusting to preset temperature, and hanging down encapsulant to one side of a crevice, time until the encapsulant which permeated a 1-cm position from one side reaches was measured.

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to 150 **, temperature up of about 10 mg of the encapsulant was carried out, the initial mass of the weight which decreased carried out it comparatively, and it asked for it with 10 ** the heating rate for /.

[0242]Gel time: 50-micrometer-thick aluminum foil was placed on the hot plate adjusted to preset

temperature, and time until it hangs down and gets about 100 mg of encapsulant on it was measured.

[0243]**** elongation after fracture: A 6x5x3-mm strip of paper was cut down from the 3-mm-thick board-like ghost, and U notch with an $r = 1.0$ -mm depth of 1 mm was minced from both sides near the center of a long side direction, and it was considered as a specimen like drawing 2. The distance between zippers was 15 mm, using the autograph placed under the environment of 23 **50%RH, it faced across the both ends by the zipper so that U notched part of a specimen might become near the center between zippers, and the tensile test was done the speed for 1-mm/. Displacement until the specimen at this time fractures was **(ed) in the distance between zippers, and was made into **** elongation after fracture.

[0244]Pull using the prismatic specimen of Tg:3mmx5mmx30mm of hardened material, and The mode, It asked with the peak temperature of tandaeta of the dynamic viscoelasticity measurement (IT measurement control company make DVA-200 use) measured on condition of for 10 Hz of test-frequencies, 0.1% of distortion, ** / power ratio 1.5, and degree of 5 ** of temperature-up side.

[0245]Extraction ion content: With 50 ml of ultrapure water, about 1 g of cut-out hardened materials were put into the container made from Teflon (R), and were sealed, and it processed on 121 **, 2 atmospheres, and the conditions of 20 hours. The obtained extract was converted into the concentration in the hardened material using the value of the content of Na and K which were obtained by analyzing by an ICP mass analysis (Yokogawa Analytical Systems, Inc. make HP-4500 use), and it asked for it. On the other hand, the same extract was converted into the concentration in the hardened material using the value of the content of Cl and Br which were obtained by analyzing by the ion chromatography method (product DXL made by die ONEKUSU J-500 use, column:AS12-SC), and it asked for it. The content in the hardened material of Na, K, Cl, and Br, which were obtained as mentioned above was totaled, and it was considered as extraction ion content.

[0246]Adhesive property: On the glass plate, the created encapsulant was applied to a thickness of 100 micrometers, and heat cure was carried out on 120 **/the conditions of 1 hour. The adhesive property was investigated by the squares tape method by the method to which the obtained coat is specified JISK5400. The thing with the mass which separated was made into x, using the mass of 10x10 of 1 mm square as the squares, and what did not peel at all was made into O.

[0247]It became a hardened material when that with which the 50-micrometer crevice which used such encapsulants for crevice penetration time measurement was filled up was heated for 10 minutes in 150 ** hot wind oven.

[0248]

[Effect of the Invention] The encapsulant of this invention has a high adhesive property, and has the characteristic which are hypoviscosity and low-temperature fast curability and was excellent as encapsulant. Therefore, the high semiconductor device of practicality can be manufactured using this.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a perspective view of the jig used for measurement of the penetration time to the crevice concerning this invention.

[Drawing 2]It is a perspective view of the specimen for measuring the **** elongation after fracture of the hardened material produced by making harden the encapsulant concerning this invention.

[Translation done.]

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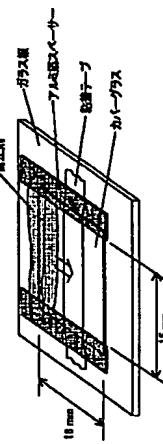
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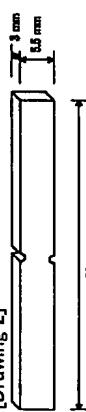
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DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]